1. For envelope assemblies containing metal framing, the U_i shall be determined by using one of the following methods:
   a. Using results from laboratory or field-test measurements where one of the procedures specified in s. Comm 63.1018 is used.
   b. Using the thermal resistance of those roof and wall assemblies listed in Tables 63.1019-1 and 63.1019-2 shall be corrected using the following parallel path correction factor procedure:

      Considering the total resistance of the series path:

      $U_i = 1/R_t$

      $R_t = R_i + R_e$

      where:

      R_t = The total resistance of the envelope assembly.

      R_i = The resistance of the series elements (for i = 1 to n) excluding the parallel path element(s).

      R_e = The equivalent resistance of the element containing the parallel path, the value of R_e is:

      R_e = R-value of insulation × F_c

      The Parallel Path Correction Factors (F_c) may be obtained from tests conducted using procedures listed in s. Comm 63.1018. Parallel Path Correction Factors for some envelope assemblies are listed in Tables 63.1019-1 and 63.1019-2.

   c. For elements with internal metallic structures bonded on one or both sides to a metal skin or covering, the calculation procedure specified in the ASHRAE *Handbook of Fundamentals*, or specified in ASHRAE standard 90.1, or other procedure acceptable to the department shall be used to include the effects of thermal bridges in metal construction.
   d. For elements other than those covered above, the zone method described in the ASHRAE *Handbook of Fundamentals* shall be used for calculation.

TABLE 63.1019-1
ROOFS
PARALLEL PATH CORRECTION FACTORS[a]

Bridged R-Value	0	5	10	15	20	25	30	35	40	45	50	55
Correction Factor	1.0	0.96	0.92	0.88	0.85	0.81	0.79	0.76	0.73	0.71	0.69	0.67

For SI: 1 inch = 25.4 mm.

a. Table values are based upon metal trusses with 4-foot spacing that penetrate the insulation, and 0.66-inch-diameter cross members every 1 foot.

TABLE 63.1019-2
WALL SECTIONS WITH METAL STUDS
PARALLEL PATH CORRECTION FACTORS

Size of Members	Gauge of Stud[a]	Spacing of Framing, in.	Cavity Insulation R-Value	Correction Factor	Effective Framing/Cavity R-Values
2 × 4	18-16	16 o.c.	R-11 R-13 R-15	0.50 0.46 0.43	R-5.5 R-6.0 R-6.4
2 × 4	18-16	24 o.c.	R-11 R-13 R-15	0.60 0.55 0.52	R-6.6 R-7.2 R-7.8
2 × 6	18-16	16 o.c.	R-19 R-21	0.37 0.35	R-7.1 R-7.4
2 × 6	18-16	24 o.c.	R-19 R-21	0.45 0.43	R-8.6 R-9.0
2 × 8	18-16	16 o.c.	R-25	0.31	R-7.8
2 × 8	18-16	24 o.c.	R-25	0.38	R-9.6

For SI: 1 inch = 25.4 mm.

a. These factors can be applied to metal studs of this gauge or thinner.

2. For assemblies containing nonmetal framing, the Ui shall be determined from one of the laboratory or field-test measurements specified in s. Comm 63.1018 or from the ASHRAE series-parallel method. Formulas in the ASHRAE *Handbook of Fundamentals*, shall be used for these calculations.
3. The opaque portions of doors shall be considered to be a part of the opaque wall assembly in the calculation of the average thermal transmittance. The thermal transmittance of the entire opaque door assembly including the frame shall be included in the calculation.

(b) Thermal transmittance of fenestration. Values of U_{of} shall be determined using one of the following methods:

1. The National Fenestration Rating Council (NFRC) 100 Procedure for Determining Fenestration Product U-Factors. The thermal performance values shall be certified through the NFRC Fenestration Thermal Performance Rating Certification and Labeling Program as described in the NFRC Product Certification Program LAP 1, PCP 1, and CAP 1.
2. The values for the appropriate product type given in IECC Table 102.5.2 (1) may be used.

Note: In order to use the component standards option of s. Comm 63.1015, the *U*-value of fenestration must be 0.60 or less.

(4) Gross area of envelope components.

(a) Roof assembly. The gross area of a roof assembly consists of the total surface of the roof assembly exposed to outside air or unconditioned spaces. The roof assembly shall be considered to include all roof or ceiling components through which heat may flow between indoor and outdoor environments including skylight surfaces but excluding service openings. For thermal transmittance purposes when return air ceiling plenums are employed, the roof or ceiling assembly shall not include the resistance of the ceiling or the plenum space as part of the total resistance of the assembly.

(b) Floor assembly. The gross area of a floor assembly over outside or unconditioned spaces consists of the total surface of the floor assembly exposed to outside air or unconditioned space. The floor assembly shall include all floor components through which heat may flow between indoor and outdoor or unconditioned space environments.

(c) Exterior walls. The gross area of exterior walls enclosing a heated or cooled space is measured on the exterior and consists of the opaque wall including between floor spandrels, peripheral edges of flooring, window areas including sash, and door areas, but excluding vents, grilles, and pipes.

(5) Shading coefficients. The shading coefficient (SC_x) for fenestration shall be obtained from the ASHRAE *Handbook of Fundamentals* or from manufacturer's test data or from IECC Section 102.5.2. SC_x is the shading coefficient of the fenestration including permanently installed internal and external shading devices but excluding the effect of external shading projections, which is calculated separately. The shading coefficient used for louvered shade screens shall be determined using a profile angle of 30 degrees as found in the ASHRAE *Handbook of Fundamentals*.

PART 4
EQUIPMENT AND SYSTEMS

Comm 63.1020 Minimum equipment efficiencies.

(1) Space heating or cooling equipment that is not covered by 10 CFR Part 430, Energy Conservation Program for Consumer Products, shall have a minimum efficiency at the specified rating conditions not less than the values given in ASHRAE 90.1, section 10.4.1.

(2) Equipment ratings shall be certified under a nationally recognized certification program or rating procedure or by data furnished by the equipment manufacturer to show compliance with the minimum efficiency requirements.

Note: The following certification programs are accepted by the department: Gas Appliance and Manufacturers Association (GAMA) and Air-Conditioning and Refrigeration Institute (ARI).

(3) Compliance with minimum efficiency requirements specified for HVAC equipment shall include compliance with part-load requirements where indicated as well as standards for full-load requirements. The part-load efficiency shall be determined as specified in ASHRAE 90.1.

(4) Space heating or cooling equipment used to provide additional functions, such as water heating for plumbing, as part of a combination or integrated system shall comply with minimum performance requirements for the appropriate space heating or cooling equipment category.

(5) Equipment providing water heating for plumbing that is used to provide additional functions, such as space heating, as part of a combination or integrated system shall comply with minimum performance requirements for water heating equipment as specified in s. Comm 84.20 (5) (n).

(6) Combination space and plumbing water heating equipment shall comply with IECC Section 504.2.2 and s. Comm 63.0504 (1).

Note: See ch. Comm 64 for additional requirements for combined systems.

(7) Equipment that is not used for comfort cooling or comfort heating is exempt from the energy efficiency requirements of this chapter.

Note: Omission of minimum performance requirements for certain classes of HVAC equipment does not preclude use of that equipment.

Comm 63.1021 Field-assembled equipment and components. When components, such as indoor or outdoor coils, from more than one manufacturer are used as parts of air-conditioning or heating equipment, component efficiencies shall be specified based on data provided by the component manufacturers.

Comm 63.1022 Heat pump equipment controls. Controls for heat pumps equipped with supplementary heaters that are installed in residential buildings shall comply with IECC Section 503.3.2.3, and controls for equipment installed in commercial buildings shall comply with IECC Sections 803.3.3.1.1.

Comm 63.1023 Load calculations for sizing.

(1) Calculation procedures. Heating and cooling system design loads for the purpose of sizing systems and equipment shall be determined in accordance with the procedures described in the ASHRAE *Handbook of Fundamentals*, or a similar computation procedure approved by the department. For those design parameters addressed in subs. (2) to (6), the values specified shall be used.

Note: This section does not require the installation of cooling equipment.

(2) Indoor design conditions. The winter indoor design temperature is specified in Table 64.0403. When air conditioning is provided in accordance with ch. Comm 64, the summer indoor design temperature is 78°F (25°C) or lower.

(3) Outdoor design conditions. Winter maximum and summer minimum for outdoor design temperatures shall be taken from Figure 63.1023.

Note: Systems may be designed for colder winter temperatures or for warmer summer temperatures.

(4) Ventilation. Outdoor air ventilation loads shall be based on ventilation rates specified in ch. Comm 64.

(5) Envelope. Envelope heating and cooling loads shall be based on envelope characteristics such as thermal conductance, shading coefficient, and air leakage consistent with the values used to demonstrate compliance with this subchapter, Part 3, building envelope.

(6) Lighting. Lighting loads shall be based on actual design lighting levels or power budgets consistent with subch. III, Part 5. Lighting loads may not be included for the purpose of calculating design heating loads.

Comm 63.1024 System and equipment sizing. HVAC systems and equipment shall be sized to provide the minimum space and system loads calculated in accordance with s. Comm 63.1023. Heating and cooling equipment and systems shall meet the minimum efficiencies in IECC Table 803.2.2 (1).

Comm 63.1026 Temperature controls.

(1) System control. Each HVAC system shall include at least one temperature control device.

(2) Zone controls.

(a) Individual thermostatic controls.

1. 'General.' Except as provided in subd. 2., the supply of heating and cooling energy to each zone shall be controlled by individual thermostatic controls responding to temperature within the zone.

2. 'Exceptions.' Independent perimeter systems that are designed to offset only envelope heat losses or gains, or both, may serve one or more zones also served by an interior system with the following limitations:

a. The perimeter system shall include at least one thermostatic control zone for each building exposure having exterior walls facing only one orientation for 50 contiguous feet (15 240 mm) or more; and

b. The perimeter system heating and cooling supply shall be controlled by thermostats located within the zones served by the system.

(b) Zone controls for comfort heating. Where used to control comfort heating, zone thermostatic controls shall be capable of being set locally or remotely by adjustment or selection of sensors down to 50°F (10°C) or lower.

(c) Zone controls for comfort cooling. Where used to control comfort cooling, zone thermostatic controls shall be capable of being set locally or remotely by adjustment or selection of sensors up to 85°F (29°C) or higher.

(d) Zone controls for both heating and cooling.

1. 'General.' Except as provided in subd. 2., zone thermostatic controls used to control both comfort heating and cooling shall be capable of providing a temperature range, or deadband, of at least 5°F (-15°C) within which the supply of heating and cooling energy to the zone is shut off or reduced to a minimum.

2. 'Exceptions.'

a. Deadbands are not required for special occupancy, special usage, or required systems where deadband controls are not appropriate.

b. Deadbands are not required for buildings complying with the ASHRAE energy cost budget method under subch. III, Part 5, if, in the proposed building energy analysis, heating and cooling thermostat set-points are set to the same value between 70°F and 75°F (21°C and 24°C) inclusive and assumed to be constant throughout the year.

c. Deadbands may be omitted for thermostats that have manual changeover between heating and cooling modes.

Comm 63.1027 Zone controls.

(1) Thermostatic and humidistatic controls. Except as provided in sub. (2), zone thermostatic and humidistatic controls shall be capable of operating in sequence to supply heating and cooling energy to the zone. Such controls shall prevent any of the following:

(a) Reheating.

(b) Recooling.

(c) Mixing or simultaneous supply of air that has been previously mechanically heated and air that has been previously cooled, either by mechanical refrigeration or by economizer systems.

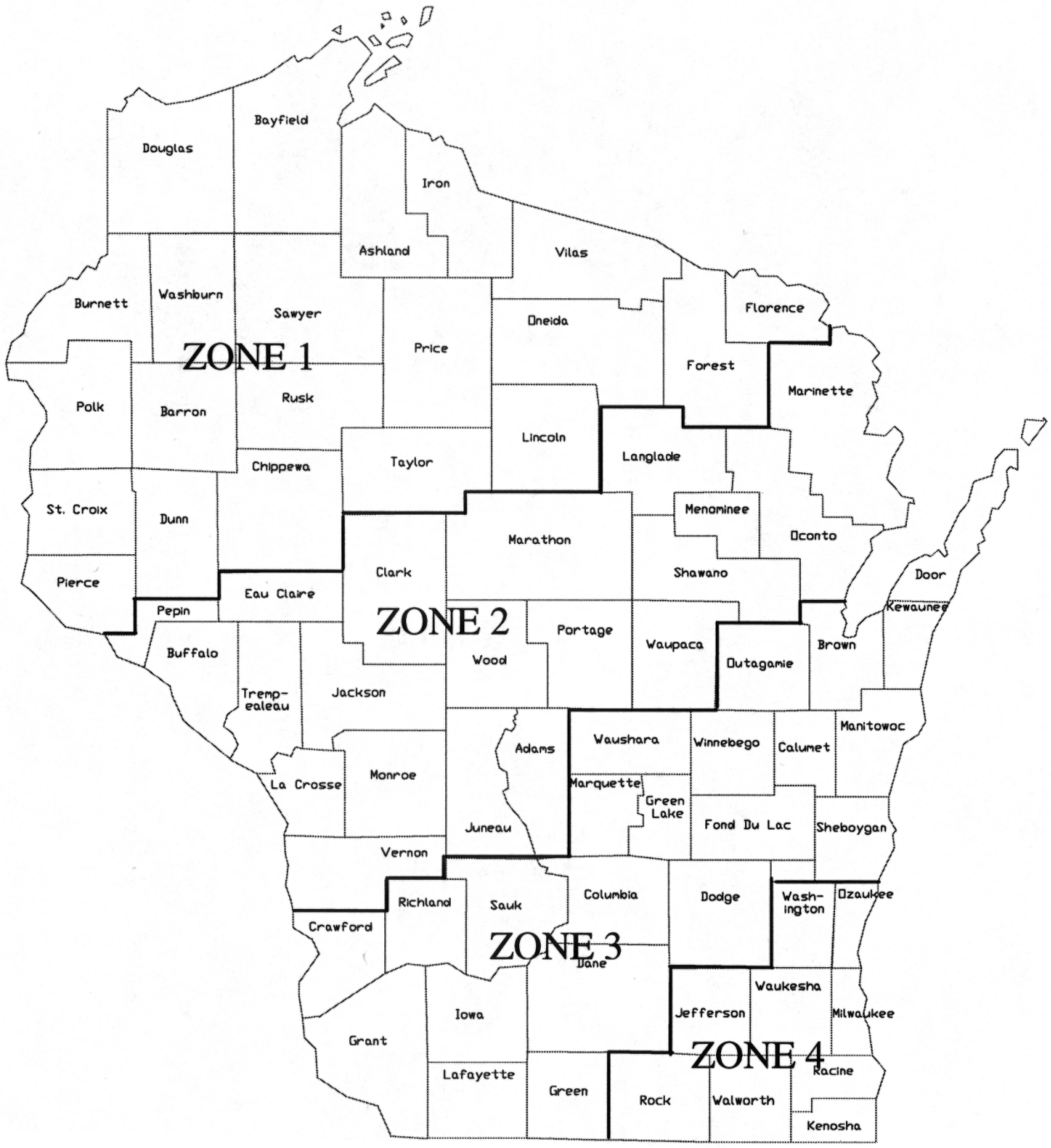

FIGURE 63.1023
OUTDOOR DESIGN CONDITIONS

Zone	Winter	Summer	
	Design Temp. (°F)	Dry Bulb (°F)	Wet Bulb (°F)
1	-25	86	75*
2	-20	87	75
3	-15	87	75
4	-10	89	77

For SI: °C = (°F-32)/1.8.
*Exception: For Douglas, Bayfield, Ashland and Iron Counties, use 70°F summer wet-bulb design temperature.

(d) Other simultaneous operation of heating and cooling systems to the same zone.

(2) Exceptions. All of the following systems and zones are exempt from this section:

(a) Variable air volume (VAV) systems which, during periods of occupancy, are designed to reduce the air supply to each zone to a minimum before reheating, recooling, or mixing takes place. This minimum volume shall be no greater than the largest of the following:

1. 30 percent of the peak supply volume.
2. The minimum required to meet ventilation requirements of ch. Comm 64.
3. 0.4 cfm/square foot of zone conditioned floor area.

(b) Zones where special pressurization relationships or cross-contamination requirements are such that VAV systems are impractical, such as isolation rooms, operating areas of hospitals, and laboratories.

(c) Where at least 75 percent of the energy for reheating or for providing warm air in mixing systems is provided from a site-recovered or site-solar energy source.

(d) Zones where specified humidity levels are required to satisfy process needs, such as computer rooms and museums.

(e) Zones with a peak supply air quantity of 150 cfm or less.

(f) Multiple reheat systems serving multiple zones, other than those employing variable air volume for temperature control, that are provided with controls that will automatically reset the system cold air supply to the highest temperature level that will satisfy the zone requiring the coolest air. In the case of direct expansion cooling systems, cooling may be cycled based on the zone requiring the coolest air or average room temperature for all zones.

(g) Dual duct and multizone systems that are provided with controls that will automatically reset all of the following:

1. The cold duct air supply to the highest temperature that will satisfy the zone requiring the coolest air.
2. The hot duct air supply to the lowest temperature that will satisfy the zone requiring the warmest air.

(h) Systems in which heated air is recooled, directly or indirectly, to maintain space temperature that are provided with controls that will automatically reset the temperature to which the supply air is heated to the lowest level that will satisfy the zone requiring the warmest air.

(i) A multiple-zone heating, ventilating and air-conditioning system that employs reheating or recooling for control of not more than 5,000 cfm or 20 percent of the total supply air of the system, whichever is less.

(3) Off-hour controls. Except as provided in pars. (a) to (c), mechanical HVAC systems shall be equipped with automatic controls capable of accomplishing a reduction of energy use through control setback or equipment shutdown during periods of nonuse or alternate use of the zones served by the system. The following systems are exempt from this subsection:

(a) Systems serving areas expected to operate continuously.

(b) Where it can be shown that setback or shutdown will not result in a decrease in overall building energy costs.

(c) Equipment with full load demands of 2 kW or 6826 Btu/h or less that is controlled by readily accessible manual off-hour controls.

Comm 63.1028 Humidity control. If a system is equipped with a means for adding moisture to maintain specific humidity levels in a zone or zones, a humidistat shall be provided in accordance with IECC Section 503.3.2.4 for residential buildings and IECC Section 803.2.3.2 for commercial buildings.

Comm 63.1029 Insulation, materials and construction.

(1) General. Insulation required by subs. (2) and (3) shall be suitably protected from damage. Insulation shall be installed in accordance with practices acceptable to the department. The department accepts MICA Commercial and Industrial Insulation Standards as an insulation installation practice.

(2) Piping insulation. Except as provided in pars. (a) to (c), recirculating plumbing system piping, plumbing piping in the first 8 feet from storage tanks for noncirculating systems, any piping served by a self-regulating electric heating cable, HVAC system piping, and related HVAC fluid conveying conduit, such as heat exchanger bodies, shall be thermally insulated in accordance with Table 63.1029 or equivalent. The following piping or conduit is exempted from this subsection:

(a) Factory-installed piping or conduit within HVAC equipment tested and rated in accordance with s. Comm 63.1020;

(b) Piping or conduit for which no insulation is specified in Table 63.1029.

(c) Where it can be shown that the heat gain or heat loss to or from piping or conduit without insulation will not increase building energy use.

(3) Air-handling system insulation. All air-handling ducts and plenums installed as part of an HVAC air distribution system shall be thermally insulated in accordance with s. Comm 63.0803 (2)(f).

(4) Additional duct sealing.

(a) General. Except as specified in par. (b), ductwork and plenums shall be sealed in accordance with Table 63.1029-1, and shall meet the duct seal classes specified in Table 63.1029-2.

(b) Exception. Ductwork and plenums confined within individual dwelling units shall comply with s. Comm 63.0503 (2) (c).

Comm 63.1030 Hydronic system controls. Hydronic system controls shall comply with IECC Section 803.3.3.7.

Comm 63.1031 Economizer controls.

(1) Fan system. Except as provided in sub. (2), each fan system shall be designed and capable of being controlled to take advantage of favorable weather conditions to reduce mechanical cooling requirements. The system shall include either of the following:

(a) A temperature or enthalpy air economizer system which is capable of automatically modulating outside air and return air dampers to provide 100 percent of the design supply air quantity as outside air for cooling;

(b) A water economizer system, which is capable of cooling supply air by direct evaporation, indirect evaporation, or both. Such a system shall be designed and capable of being controlled to provide 100 percent of the expected system cooling load at outside air temperatures of 50°F (10°C) dry-bulb/40ºF (4°C) wet-bulb and below.

(2) Exceptions. All of the following systems are exempt from this subsection:

(a) Individual fan-cooling units with a supply capacity of less than 2,000 cfm or a total system cooling capacity of less than 62,000 Btu/hour for split systems or less than 36,000 Btu/hour for all other types. The total capacity of all such units complying by use of this exception shall not exceed 600,000 Btu/hour per building or 10 percent of the total installed cooling capacity, whichever is larger;

(b) Systems with air or evaporatively cooled condensers for which it can be shown that the use of outdoor air cooling affects the operation of other systems, such as humidification, dehumidification, or supermarket refrigeration systems, so as to increase overall building energy costs;

Note: Other areas that may use controlled humidification or dehumidification are computer rooms, museums, library stacks and drafting rooms.

(c) Where the overall building energy use resulting from alternative designs, such as internal to external zone heat recovery systems, can be shown to be less than those resulting from an economizer system.

Comm 63.1032 Electrical motors.

(1) Permanently wired motors. Any permanently wired motor that meets all of the criteria specified in pars. (a) through (g) shall meet the efficiency requirements specified in Table 63.1032 and the requirements of this section:

(a) The motor is used in a HVAC fan or pumping system.

(b) The motor is polyphase.

(c) The motor is 1 horsepower or more.

(d) The motor is a design A or B squirrel-cage, foot-mounted, T-frame induction motor that has synchronous speeds of 3,600, 1,800, 1,200, and 900 rpm.

(e) The motor is expected to operate more than 1000 hours per year.

TABLE 63.1029
PLUMBING AND HVAC PIPING MINIMUM INSULATION [in.[a] (R-Value)]

Fluid Design Operating Temp. Range, °F	Insulation Conductivity[a]		Nominal Pipe Diameter [in. (R-value)]					
	Conductivity Range Btu.in./-(h · ft² · °F)	Mean Rating Temp. °F	Runouts[b] up to 2	1 and less	1 1/4 to 2	2 1/2 to 4	5 and 6	8 and up
Heating systems (Steam, Steam Condensate, and Hot Water)								
Above 350	0.32-0.34	250	1.5(R-4.4)	1.5(R-4.4)	2.5(R-7.4)	3.0(R-8.8)	3.5(R-10.3)	3.5(R-10.3)
251-350	0.29-0.31	200	1.5(R-4.8)	1.5(R-4.8)	2.5(R-8.1)	2.5(R-8.1)	3.5(R-11.3)	3.5(R-11.3)
201-250	0.27-0.30	150	1.0(R-3.3)	1.0(R-3.3)	1.5(R-5.0)	2.0(R-6.7)	2.0(R-6.7)	3.5(R-11.7)
141-200	0.25-0.29	125	0.5(R-1.8)	0.5(R-1.8)	1.5(R-5.2)	1.5(R-5.2)	1.5(R-5.2)	1.5(R-5.2)
105-140	0.24-0.28	100	0.5(R-1.8)	0.5(R-1.8)	1.0(R-3.6)	1.0(R-3.6)	1.0(R-3.6)	1.5(R-5.4)
Domestic and Service Hot Water systems[c]								
105 and greater	0.24-0.28	100	0.5(R-1.8)	1.0(R-3.6)	1.0(R-3.6)	1.5(R-5.4)	1.5(R-5.4)	1.5(R-5.4)
Cooling systems (Chilled water, brine, and refrigerant)[d]								
40-55	0.23-0.27	75	0.5(R-1.9)	0.5(R-1.9)	0.75(R-2.8)	1.0(R-3.7)	1.0(R-3.7)	1.0(R-3.7)
Below 40	0.23-0.27	75	1.0(R-3.7)	1.0(R-3.7)	1.5(R-5.6)	1.5(R-5.6)	1.5(R-5.6)	1.5(R-5.6)

For SI: °C = (°F-32)/1.8, 1 inch = 25.4 mm.

a. For insulation outside the state conductivity range, the minimum thickness (T) shall be determined as follows: $T=PR[(1+t/PR)^{K/k}-1]$, where T = minimum insulation thickness for material with conductivity K, in.; PR = actual outside radius of pipe, in.; t = insulation thickness, in.; K = conductivity of alternate material at mean rating temperature indicated for the applicable fluid temperature; and k = the lower value of the conductivity range listed for the applicable fluid temperature.

b. Runouts to individual terminal units not exceeding 12 ft. in length.

c. Applies to recirculating sections of service or domestic hot water systems and first 8 ft. from storage tank for nonrecirculating systems.

d. The required minimum thickness does not consider water vapor transmission and condensation.

TABLE 63.1029-1
MINIMUM DUCT SEAL LEVEL[a]

DUCT LOCATION	DUCT TYPE			
	Supply		Exhaust	Return
	≤ 2 in. w.c.[b] (500 Pa)	> 2 in. w.c.[b] (500 Pa)		
Outdoors[c]	A	A	C	A
Unconditioned Spaces	B	A	C	B
Conditioned Spaces	C	B	B	C

a. See Table Comm 63.0803-2 definition of Seal Class.
b. Duct design static pressure classification.
c. Includes indirectly conditioned spaces, such as return air plenums.

TABLE 63.1029-2
DUCT SEAL CLASSES

DUCT SEAL CLASS	SEALING REQUIREMENTS[a]
A	All transverse joints, longitudinal seams, and duct wall penetrations. Pressure-sensitive tape shall not be used as the primary sealant.
B	All transverse joints and longitudinal seams. Pressure-sensitive tape shall not be used as the primary sealant.
C	Transverse joints only.

a. Longitudinal seams are joints oriented in the direction of airflow. Transverse joints are connections of two duct sections and are oriented perpendicular to airflow. Duct wall penetrations are openings made by any screw fastener, pipe, rod or wire. Spiral lock seams in round and flat oval ducts need not be sealed. All other connections are considered transverse joints, including but not limited to spin-ins, taps and other branch connections, access door frames and jambs, and duct connections to equipment.

(f) The motor is not a multispeed motor used in a system designed to use more than one speed.

(g) The motor is not a component of equipment that meets the efficiency requirements of s. Comm 63.1020 where motor input is included in the determination of the equipment efficiency.

(2) Motor nameplate. The motor nameplate shall list the minimum nominal full-load motor efficiency.

Note: Motors that are classified as "energy efficient" under the National Electric Manufacturer's Association Standard MG 12.55, dated 3-14-91, are acceptable to the department as meeting the efficiency requirements of this section.

PART 5
LIGHTING POWER

Comm 63.1040 Scope.

(1) General. Except as specified in sub. (2), sections Comm 63.1041 to 63.1051 shall apply to all of the following rooms, spaces and areas:

(a) Interior spaces of buildings.

(b) Building exteriors and exterior areas such as entrances, exits, and loading docks.

(c) Roads, grounds, parking, and other exterior areas where lighting is energized through the building electrical service.

(2) Exceptions. Lighting that is specifically designated as required by a health or life safety regulation is exempt.

Comm 63.1041 Exterior lighting power requirement. The exterior lighting power of a building or a group of buildings in a multibuilding facility calculated in accordance with s. Comm 63.1042 shall be no greater than the lighting power allowance calculated in accordance with s. Comm 63.1043.

Comm 63.1042 Calculation of exterior lighting power. The calculated exterior lighting power is the sum of the power for all exterior luminaires that are included in s. Comm 63.1040, minus the power for exempted exterior lighting as specified in subs. (1) to (5).

(1) Task lighting for outdoor activities such as manufacturing and processing facilities.

(2) Lighting power for theatrical productions.

(3) Lighting for outdoor sporting facilities, including playing and seating areas.

(4) Lighting for dwelling units that is controlled within the dwelling unit.

(5) Exit way or egress lighting required by s. Comm 73.21 that has switching regulated by Article 700 of the *National Electrical Code.*

Comm 63.1043 Exterior lighting power allowance.

(1) Calculation method. The exterior lighting power allowance for a building or a multibuilding facility is the sum of all the allowed lighting powers for all exterior areas. The lighting power for each area is calculated by multiplying the unit power allowance from Table 63.1043 by the applicable length or area.

(2) Applicable areas and lengths. The applicable areas and lengths used with Table 63.1043 to calculate the exterior lighting power allowance are described in pars. (a) to (d).

(a) Horizontal areas of grounds, driveways, lots, gardens or parks may be calculated as if they were flat, or the actual area of the surfaces of contours may be used.

TABLE 63.1032
MINIMUM ACCEPTABLE NOMINAL FULL-LOAD MOTOR EFFICIENCY FOR SINGLE-SPEED POLYPHASE SQUIRREL-CAGE INDUCTION MOTORS HAVING SYNCHRONOUS SPEEDS OF 3,600, 1,800, 1,200 AND 900 RPM

Full-Load Efficiencies—Open Motors								
	2-Pole		4-Pole		6-Pole		8-Pole	
HP	Nominal Efficiency	Minimum Efficiency	Nominal Efficiency	Minimum Efficiency	Nominal Efficiency	Minimum Efficiency	Nominal Efficiency	Minimum Efficiency
1.0	—	—	82.5	81.5	80.0	78.5	74.0	72.0
1.5	82.5	81.5	84.0	82.5	84.0	82.5	75.5	74.0
2.0	84.0	82.5	84.0	82.5	85.5	84.0	85.5	84.0
3.0	84.0	82.5	86.5	85.5	86.5	85.5	86.5	85.5
5.0	85.5	84.0	87.5	86.5	87.5	86.5	87.5	86.0
7.5	87.5	86.5	88.5	87.5	88.5	87.5	88.5	87.5
10.0	88.5	87.5	89.5	88.5	90.2	89.5	89.5	88.5
15.0	89.5	88.5	91.0	90.2	90.2	89.5	89.5	88.5
20.0	90.5	89.5	91.0	90.2	91.0	90.2	90.2	89.5
25.0	91.0	90.2	91.7	91.0	91.7	91.0	90.2	89.5
30.0	91.0	90.2	92.4	91.7	92.4	91.7	91.0	90.2
40.0	91.7	91.0	93.0	92.4	93.0	92.4	91.0	90.2
50.0	92.4	91.7	93.0	92.4	93.0	92.4	91.7	91.0
60.0	93.0	92.4	93.6	93.0	93.6	93.0	92.4	91.7
75.0	93.0	92.4	94.1	93.6	93.6	93.0	93.6	93.0
100.0	93.0	92.4	94.1	93.6	94.1	93.6	93.6	93.0
125.0	93.6	93.0	94.5	94.1	94.1	93.6	93.6	93.0
150.0	93.6	93.0	95.0	94.5	94.5	94.1	93.6	93.0
200.0	94.5	94.1	95.0	94.5	94.5	94.1	93.6	93.0
Full-Load Efficiencies—Enclosed Motors								
	2-Pole		4-Pole		6-Pole		8-Pole	
HP	Nominal Efficiency	Minimum Efficiency	Nominal Efficiency	Minimum Efficiency	Nominal Efficiency	Minimum Efficiency	Nominal Efficiency	Minimum Efficiency
1.0	75.5	74.0	82.5	81.5	80.0	78.5	74.0	72.0
1.5	82.5	81.5	84.0	82.5	85.5	84.0	77.0	75.5
2.0	84.0	82.5	84.0	82.5	86.5	85.5	82.5	81.5
3.0	85.5	84.0	87.5	86.5	87.5	86.5	84.0	82.5
5.0	87.5	86.5	87.5	86.5	87.5	86.5	85.5	84.0
7.5	88.5	87.5	89.5	88.5	89.5	88.5	85.5	84.0
10.0	89.5	88.5	89.5	88.5	89.5	88.5	88.5	87.5
15.0	90.2	89.5	91.0	90.2	90.2	89.5	88.5	87.5
20.0	90.2	89.5	91.0	90.2	90.2	89.5	89.5	88.5
25.0	91.0	90.2	92.4	91.7	91.7	91.0	89.5	88.5
30.0	91.0	90.2	92.4	91.7	91.7	91.0	91.0	90.2
40.0	91.7	91.0	93.0	92.4	93.0	92.4	91.0	90.2
50.0	92.4	91.7	93.0	92.4	93.0	92.4	91.7	91.0
60.0	93.0	92.4	93.6	93.0	93.6	93.0	91.7	91.0
75.0	93.0	92.4	94.1	93.6	93.6	93.0	93.0	92.4
100.0	93.6	93.0	94.5	94.1	94.1	93.6	93.0	92.4
125.0	94.5	94.1	94.5	94.1	94.1	93.6	93.6	93.0
150.0	94.5	94.1	95.0	94.5	95.0	94.5	93.6	93.0
200.0	95.0	94.5	95.0	94.5	95.0	94.5	94.1	93.6

(b) Canopied areas are the area of the horizontal surface under the canopy. A canopy includes an exterior awning, soffit or ornamental or functional structure signifying a main entrance to a building.

(c) The linear length of door openings is measured in plan view and includes the door opening only. Sidelights and other portions of the door, which do not open, are not included.

(d) The applicable area of the building facade includes all vertical and horizontal areas that are intended to be illuminated.

TABLE 63.1043
EXTERIOR LIGHTING UNIT POWER ALLOWANCES

Area Description	Allowances
Canopies (not associated with an entrance)	4 W/ft^2
Commerce or merchandizing areas	4 W/ft^2
Exit (with or without canopy)	16 W/lin ft of door opening
Entrance (without canopy)	20 W/lin ft of door opening
Entrance (with canopy)	
High traffic (retail, hotel, airport, theater, etc.)	6.6 W/ft^2 of canopied area
Light traffic (hospital, office, school, etc.)	2.6 W/ft^2 of canopied area
Loading area	0.26 W/ft^2
Loading door	13 W/lin ft of door opening
Building exterior surfaces/facades	0.16 W/ft^2 of surface area to be illuminated
Storage and nonmanufacturing work areas	0.13 W/ft^2
Other activity areas for casual use such as picnic grounds, gardens, parks and other landscaped areas	0.06 W/ft^2
Private driveways/walkways	0.06 W/ft^2
Public driveways/walkways	0.10 W/ft^2
Private parking lots	0.08 W/ft^2
Public parking lots	0.12 W/ft^2
Pump island canopies	4 W/ft^2

Comm 63.1044 Interior lighting power requirement. The interior lighting power of a building calculated in accordance with s. Comm 63.1045 shall be no greater than the interior lighting power allowance calculated in accordance with s. Comm 63.1046.

Comm 63.1045 Calculation of interior lighting power. The calculated interior lighting power of a building is the total watts of all interior luminares including, but not limited to, track and flexible lighting systems, lighting that is integral with modular furniture, movable displays and cabinets, and internally illuminated case work for task or display purposes, minus any adjustments allowed under subs. (1) through (4).

(1) Multiple interlocked lighting systems serving a space. When multiple interlocked lighting systems serve a space, the watts of all systems except the system with the highest wattage may be excluded from the calculated lighting power if:

(a) The lighting systems are interlocked to prevent simultaneous operation; or

(b) The lighting systems are controlled by a preset dimming system or other device that prevents simultaneous operation of more than one lighting system, except under the direct control of authorized personnel.

(2) Reduction of wattage through controls. The watts of any luminaire that is controlled may be reduced by the number of watts times the applicable power adjustment factor from Table 63.1045 if all of the following are met:

(a) The control complies with s. Comm 63.1051.

(b) At least 50 percent of the light output of the luminaire is within the applicable space listed in Table 63.1045.

(c) Except as noted in Table 63.1045, only one power adjustment factor is used for the luminaire.

(d) For daylighting control credits, the luminaire is controlled by the daylighting control, and the luminaire is located within the daylit area.

(e) For automatic time switch control devices, a timed manual override is provided at each switch location required by s. Comm 63.1050. The override device shall control only the lights in the surrounding area enclosed by ceiling-height partitions.

(3) Lighting wattage excluded. The watts of the following lighting applications may be excluded from the calculated interior lighting power of the building.

(a) Lighting for theatrical productions and other live performances, television broadcasting, audio-visual presentations, and those portions of entertainment facilities such as stage areas in hotel ballrooms, night clubs, dance floors, churches, and casinos where lighting is an essential technical element for the function performed, if the lighting is an addition to a general lighting system, and if the lighting is separately controlled and accessible only to authorized operators.

(b) Lighting for television, video and film production.

(c) Lighting for photographic processes.

(d) Lighting for the amusement and attraction areas in theme parks.

(e) Lighting for exhibits in areas such as exhibit, convention, and hotel function areas, if the lighting is an addition to a general lighting system, and if the lighting is separately controlled and accessible only to authorized operators.

(f) Specialized local lighting installed in nonlighting process equipment by its manufacturer used to illuminate process-related tasks only.

(g) In buildings for medical and clinical care, examination and surgical lights, low-level night lights, and lighting integral to medical equipment.

(h) Lighting fixtures that are an integral part of refrigeration equipment.

TABLE 63.1045
LIGHTING POWER ADJUSTMENT FACTORS

Type of Control	Type of Space	Factor
Automatic daylighting controls Continuous dimming Multiple step dimming On/off	Daylit areas	 0.30 0.20 0.10
Automatic time switch control device in conjunction with automatic daylighting controls Continuous dimming Multiple step dimming On/off	Daylit areas ≤250 square feet	 0.35 0.25 0.15
Automatic time switch control device in conjunction with lumen maintenance and automatic daylighting controls Continuous dimming Multiple step dimming On/off	Daylit areas ≤250 square feet	 0.40 0.30 0.20
Lumen maintenance	Any space	0.10
Lumen maintenance in conjunction with an automatic time switch control device	Spaces ≤250 square feet	0.15
Automatic time switch control device	Spaces ≤250 square feet	0.15
Occupant-sensing device with a separate sensor for each space	Spaces ≤ 250 square feet enclosed by opaque floor-to-ceiling partitions; any size classroom, corridor, conference or waiting room	0.30*
Occupant-sensing device with separate sensor for each space	Rooms of any size that are used exclusively for storage	0.60*
Occupant-sensing device with separate sensor for each space	Spaces > 250 square feet	0.10*
Occupant-sensing device with a separate sensor for each space used in conjunction with daylighting controls and separate sensor for each space Continuous dimming Multiple step dimming On/off	Spaces ≤ 250 square feet within a daylit area and enclosed by opaque floor-to-ceiling partitions	 0.40* 0.35* 0.35*
Occupant-sensing device with a separate sensor for each space used in conjunction with daylighting controls and separate sensor for each space and lumen maintenance Continuous dimming Multiple step dimming On/off	Spaces ≤ 250 square feet within a daylit area and enclosed by opaque floor-to-ceiling partitions	0.35* 0.45* 0.40* 0.35*
Occupant-sensing device with a separate sensor for each space used with lumen maintenance	Spaces ≤ 250 square feet and enclosed by opaque floor-to-ceiling partitions	0.35*
Occupant-sensing device with a separate sensor for each space used in conjunction with an automatic time switch control device	Spaces ≤ 250 square feet enclosed by opaque floor-to-ceiling partitions	0.35*
Manual dimming system	Hotels, motels, restaurants, auditoriums, theaters	0.10
Multiscene programmable dimming system	Hotels, motels, restaurants, auditoriums, theaters	0.20
Occupant-sensing device with programmable multiscene dimming system	Hotels, motels, restaurants, auditoriums, theaters	0.35

For SI: 1 square foot = 0.0929m^2.

***Note to Table 63.1045:** Adjustment factors for occupant-sensing devices are for devices with on-off operation. If devices are used that turn lights down, rather than off, the adjustment factor shall be multiplied by the percent of energy savings that occur while the lights are turned down.

(i) Nonretail display lighting required for art exhibits or displays in galleries, museums and monuments.

(j) Special lighting needed for research.

(k) Task lighting for plant growth or maintenance, if it is equipped with an automatic 24-hour time switch that has program back-up capabilities that prevent the loss of the switch's program and time setting for at least 10 hours if power is interrupted.

(l) Exit way or egress illumination that is normally off.

(m) Task lighting specifically designed for primary use by visually impaired, for lip reading, and by senior citizens.

(n) Lighting for informational signs and exit signs, but excluding commercial displays.

Note: See s. Comm 63.1005 (38) for definition of informational sign and s. Comm 63.1052 for exit sign requirements.

(o) Display window lighting in retail facilities provided the display area is separated from the store sales area by opaque ceiling-height partitions.

(p) Lighting in dwelling units that provides complete independent living facilities for one or more persons including permanent provisions for living, sleeping, eating, cooking, and sanitation.

(q) In restaurant buildings and areas, lighting for food warming or integral to food preparation equipment.

(r) Lighting equipment that is for sale.

(s) Lighting demonstration equipment in lighting education facilities.

(4) Lighting fixtures that allow substitution of sources. The watts of track and other lighting fixtures that allow the substitution of low-efficacy sources for high-efficacy sources without altering the wiring of the fixture shall be determined by this subsection or other method approved by the department.

(a) Track and busway line-voltage lighting. The wattage of line-voltage lighting track and plug-in busway that allow the addition and relocation, or both, of luminaries without altering the wiring of the system shall be the specified wattage of the luminaries included in the system with a minimum of 30 W/lin ft.

(b) Low-voltage lighting systems. The wattage of low-voltage lighting track, cable conductor, rail conductor, and other flexible lighting systems that allow the addition or relocation, or both, without altering the wiring of the system shall be the specified wattage of the transformer supplying the system.

(c) Incandescent medium base sockets. The wattage for medium base fixtures shall be the listed lighting power capacity, in watts, of the fixture.

Comm 63.1046 Calculation of interior lighting power allowance. The interior lighting power allowance shall be calculated using one of the methods in s. Comm 63.1047, 63.1048, or 63.1049 as applicable.

Comm 63.1047 Complete building method. The complete building method may be used only on projects involving entire buildings where at least 80 percent of the areas of the building are the same type of use. Under this approach, the interior lighting power allowance is the lighting power density value in Table 63.1047 times the floor area of the entire building. Hotel, motel and residential buildings shall not use this method. Building uses that are not listed in Table 63.1047 shall be assigned the allowed lighting power density given under "All Others."

TABLE 63.1047
COMPLETE BUILDING METHOD—
LIGHTING POWER DENSITY VALUES (Watts/ft^2)

TYPE OF USE	ALLOWED LIGHTING POWER DENSITY
Banks and Financial Institutions	1.7
Correctional Housing	1.4
General Commercial and Industrial Work Buildings	1.2
Grocery Store	1.8
Industrial and Commercial Storage Buildings	0.8
Medical Buildings and Clinics	1.5
Office Building	1.5
Religious Worship, Auditorium, and Convention Centers	2.0
Restaurants	1.5
Retail and Wholesale Store	2.6
Schools	1.8
Theaters	1.5
All Others	0.8

Comm 63.1048 Area category method. Under the area category method, the interior lighting power allowance for the building is the sum of all allowed lighting powers for all areas in the building. The allowed lighting power for an area is the lighting power density in Table 63.1048 times the area. For purposes of the Area Category Method, an "Area" means all contiguous spaces that accommodate or are associated with a single one of the primary functions listed in Table 63.1048. Buildings with primary functions not listed in Table 63.1048 shall not use this method. Where areas are bounded or separated by interior partitions, the floor space occupied by those interior partitions shall not be included in any area. The area shall not include enclosed retail display windows with exempted lighting as described in s. Comm 63.1045 (3) (o). When the Area Category Method is used to calculate the interior lighting power allowance for an entire building, main entry lobbies, corridors, rest rooms, and support functions shall be treated as separate areas.

Comm 63.1049 Activity method. Under the activity method, the interior lighting power allowance for a building is determined by calculating a lighting power budget for each space in accordance with subs. (1) to (4) and summing them in accordance with sub. (5).

(1) The lighting power budget of each interior space shall be determined in accordance with the following equation:

$$LPB = A \times UPD \times AF$$

where:
LPB = lighting power budget of the space, W
A = area of the space, ft² (m²)
UPD = unit power density, W/ft² [Table 63.1049]
AF = area factor of the room [Figure 63.1049]

(a) The *UPD* shall be selected from Table 63.1049. For applications to areas or activities other than those given, select values for the most similar areas or activities. The *UPD* for a multifunctional space shall be based on the lowest *UPD* of any of the activities of the space.

TABLE 63.1048
AREA CATEGORY METHOD —
LIGHTING POWER DENSITY VALUES (Watts/ft²)

PRIMARY FUNCTION	ALLOWED LIGHTING POWER DENSITY
Auditorium	2.0
Auto Repair	2.0
Bank/Financial Institution	1.8
Classrooms	2.0
Convention, Conference and Meeting Centers	1.6
Corridors, Rest Rooms and Support Areas	0.8
Detention Facilities	1.6
Dining	1.2
Exhibit	2.3
Storage Garage	0.2
General Commercial and Industrial Work	1.3
Grocery	2.0
Guestroom or Dorm Room	1.4
Hotel Function	2.3*
Industrial and Commercial Storage	0.6
Kitchen	2.2
Laboratory	3.3
Lobbies:	
Hotel Lobby	2.3*
Main Entry Lobby	1.6*
Malls, Arcades, and Atria	1.2*
Medical and Clinical Care	1.8
Office	1.6
Precision Commercial and/or Industrial Work	2.0
Religious Worship	2.2*
Retail Sales, Wholesale Showrooms	2.8
Theaters	
Motion Picture	1.0
Performance	1.5*

* **Note to Table 63.1048:** The smallest of the following values may be added to the allowed lighting power listed in Table 63.1048 for ornamental chandeliers and sconces that are switched or dimmed on circuits different from the circuits for general lighting:

a. 1 watt per square foot times the area of the space in which the chandelier or sconce is used; or

b. The actual design wattage of the chandelier or sconce.

(b) The area factor (*AF*) shall be determined from Figure 63.1049 based on the room area (A_r) and ceiling height. The room area shall be calculated from the inside dimensions of the room. Rooms of identical ceiling height and activities may be evaluated as a group. The AF of a group of rooms shall be determined from the average area of these rooms.

The following equation gives the formula used in developing Fig. 63.1049.

$$AF = 0.2 + 0.8(1/0.9^n)$$

where:

$$n = \left[\frac{10.21\,(CH - 2.5)}{\sqrt{A_r}}\right] - 1$$

AF = Area factor
CH = Average ceiling height, ft. (mm)
A_r = Room area, ft² (m²)
If $AF < 1.0$, then $AF = 1.0$
If $AF > 1.8$, then $AF = 1.8$

(2) For rooms serving multiple functions such as hotel banquet or meeting rooms and office conference or presentation rooms; an adjustment factor of 1.5 times the *UPD* may be used if a supplementary system is actually installed and meets all of the following conditions:

(a) The installed power for the supplementary system shall not be greater than 33 percent of the adjusted lighting power budget calculated for that space.

(b) Independent controls shall be installed for the supplementary system.

(3) In rooms containing multiple simultaneous activities, such as a large general office having separate accounting and drafting areas within the same room, the lighting power budget for the rooms shall be the weighted average of the activities in proportion to the areas being served.

(4) The activity of indoor sports areas shall be considered as an area 10 feet (3048 mm) beyond the playing boundaries of the sport, not to exceed the total floor area of the indoor sports space less the spectator seating area.

(5) The interior lighting power allowance shall be calculated in accordance with the following equation. The interior lighting power allowance shall include a 0.20 W/ft² allowance for unlisted spaces.

$$ILPA = (LPB_1 + LPB_2 + \ldots + LPB_n) + (0.20\ \text{W/ft}^2 \times \text{unlisted space area})$$

where:

ILPA = interior lighting power allowance, *W*
Unlisted space area = $GLA - \sum (LS)$, ft² (m²)
GLA = gross lighted area, ft² (m²)
LPB = lighting power budget, *W*
LS = listed space